



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 85 Highwood Avenue
EASTLEIGH, SO50 9QY

Contact: Scott Spearing
Scott Spearing
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Report Issue Date: 06/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 211				Issued on Date	06/03/2023
Assessment Reference	AB	Prop Type Ref	Type 5			
Property	85 Highwood Avenue, EASTLEIGH, SO50 9QY					
SAP Rating	87 B	DER	15.21	TER	18.91	
Environmental	87 B	% DER<TER	19.57			
CO ₂ Emissions (t/year)	1.07	DFEE	55.04	TFEE	59.96	
General Requirements Compliance	Pass	% DFEE<TFEE	8.21			
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.91	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.21	kgCO ₂ /m ²	Pass
	-3.70 (-19.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.96	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	55.04	kWh/m ² /yr	
	-5.0 (-8.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.18 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

7.42 m², No overhang

Windows facing East

4.14 m², No overhang

Windows facing South East

1.81 m², No overhang

Windows facing South West

4.91 m², No overhang

Windows facing West

2.58 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.18 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Photovoltaic array

1.28

kW

BASIC COMPLIANCE REPORT

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This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

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SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements				
		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	28.93 m	46.48 m ²	2.40 m
	1st Storey:	28.93 m	46.48 m ²	2.66 m

7.0 Living Area	14.19	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	84.96	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	146.39	123.37

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
		Double plasterboard on both sides, twin timber f rame with/without sheathing board		20.00	

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall - GF	Plasterboard on timber frame		9.00	54.19	
Internal Wall - FF	Plasterboard on timber frame		9.00	80.24	

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	46.48	46.48

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	46.48

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.17	75.00	46.48

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	46.48

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Solid Doors	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Wall	South West							2.16	
Front Elevation	Window	[1] External Wall	South West	None	0.00					4.91	
West	Window	[1] External Wall	West	None	0.00					2.58	
Rear Elevation	Window	[1] External Wall	North East	None	0.00					7.42	
East	Window	[1] External Wall	East	None	0.00					4.14	
Side Elevation	Window	[1] External Wall	South East	None	0.00					1.81	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	16.35	0.300	Yes
Table K1 - Approved	E3 Sill	15.33	0.040	Yes
Table K1 - Approved	E4 Jamb	39.30	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	28.93	0.160	Yes
Table K1 - Approved	E6 Intermediate floor within a dwelling	28.93	0.070	Yes
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	19.33	0.060	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	9.60	0.240	No
Table K1 - Approved	E16 Corner (normal)	20.24	0.090	Yes
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	5.06	-0.090	No

Y-value	0.079	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	6.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	5.18	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Description	Database	
Percentage of Heat	Gas Boiler	%
Database Ref. No.	100	
Fuel Type	17929	
Main Heating	Mains gas	
SAP Code	BGW	
In Winter	104	
In Summer	90.5	
Controls	87.3	
PCDF Controls	CBE Programmer, room thermostat and TRVs	
Delayed Start Stat	0	
Sap Code	Yes	
Flue Type	2106	
Fan Assisted Flue	Balanced	
Is MHS Pumped	Yes	
Heat Emitter	Pump in heated space	
Flow Temperature	Radiators	
Combi boiler type	Normal (> 45°C)	
Combi keep hot type	Standard Combi	
	None	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

HWP From main heating 1

SUMMARY FOR INPUT DATA

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Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.28	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£79	B 88	

U-VALUE CALCULATOR REPORT

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Client	Highwood Construction Ltd, HIGHWOOD		

Building Elements

Roof Pitched Roof - 400mm Quilt

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool				
	Main construction	300	0.0400	7.5000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Mineral wool				
	Main construction	100	0.0400	2.5000	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 10.046 m ² K/W	Lower limit = 9.832 m ² K/W	Average = 9.939 m ² K/W
	Total correction = 0.0005 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

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Building Elements

Wall 000001 - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.2900	
Layer 1	Brick, outer leaf				
	Main construction	100	0.7700	0.0000	82.81
	Main construction	100	0.9407	0.0000	17.19
Layer 2	Standard cavity				
	Main construction	50	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Low Emissivity (BR443)				
Layer 3	Breather membrane				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)				
Layer 6	Celotex GA4000				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)				
Layer 8	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 9	Service Void				
	Main construction	25	0.0321	0.7800	89.63
	Main construction	25	0.1300	0.1923	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 11	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: Upper limit = 5.477 m² K/W Lower limit = 4.778 m² K/W Average = 5.128 m² K/W
Total correction = 0.0041 m² K/W U-value (unrounded) = 0.2 W/m² K

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

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Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

Area = 46.48 m², Perimeter = 28.93 m, Wall thickness = 275.00 mm, Soil: Unknown

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.200 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Blockwork, dense				
	Main construction	100	1.5900	0.0629	82.95
	Main construction	100	2.2000	0.0455	17.05
Layer 2	Jablite Jabfloor (HP)				
	Main construction	150	0.0320	4.6875	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 5.153 m² K/W Lower limit = 5.152 m² K/W Average = 5.152 m² K/W

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.17 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.17 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.91 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)60.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.18 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing North East: 7.42 m², No overhang

Windows facing East: 4.14 m², No overhang

Windows facing South East: 1.81 m², No overhang

Windows facing South West: 4.91 m², No overhang

Windows facing West: 2.58 m², No overhang

Air change rate: 8.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Photovoltaic array 1.28 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1276 (8)				
Pressure test							Yes					
Measured/design AP50							5.1800					
Infiltration rate							0.3866	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3866 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4929	0.4832	0.4735	0.4252	0.4155	0.3672	0.3672	0.3576	0.3866	0.4155	0.4349	0.4542 (22b)
Effective ac	0.6215	0.6167	0.6121	0.5904	0.5863	0.5674	0.5674	0.5639	0.5747	0.5863	0.5946	0.6032 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			20.8600	1.3258	27.6553		(27)
Heat Loss Floor			46.4800	0.1700	7.9016	75.0000	3486.0000 (28a)
External Wall	146.3900	23.0200	123.3700	0.2000	24.6740	9.0000	1110.3300 (29a)
External Roof	46.4800		46.4800	0.1000	4.6480	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			239.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.9029		(33)
Internal Wall - GF			54.1900			9.0000	487.7100 (32c)
Internal Wall - FF			80.2400			9.0000	722.1600 (32c)
Internal Floor			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7897.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							84.9591 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.9671 (36)
Total fabric heat loss						(33) + (36) =	86.8700 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.2326	47.8666	47.5078	45.8225	45.5072	44.0394	44.0394	43.7676	44.6048	45.5072	46.1451	46.8119 (38)
Heat transfer coeff	135.1026	134.7366	134.3778	132.6925	132.3772	130.9094	130.9094	130.6376	131.4748	132.3772	133.0151	133.6819 (39)
Average = Sum(39)m / 12 =												132.6910 (39)
HLP	1.4533	1.4494	1.4455	1.4274	1.4240	1.4082	1.4082	1.4053	1.4143	1.4240	1.4309	1.4381 (40)
HLP (average)												1.4274 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	Jan 107.2198	Feb 103.3209	Mar 99.4220	Apr 95.5231	May 91.6242	Jun 87.7253	Jul 87.7253	Aug 91.6242	Sep 95.5231	Oct 99.4220	Nov 103.3209	Dec 107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)												Total = Sum(45)m = 1533.6226 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1382	12.7590	14.0990	13.5996	14.0205	13.5309	13.9587	13.9988	13.5683	14.0665	13.6531	14.1261 (61)
Total heat required for water heating calculated for each month	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (64)
								Total per year (kWh/year) = Sum(64)m =				1699.1414 (64)
Heat gains from water heating, kWh/month	56.4033	49.4291	51.2396	44.9989	43.4204	37.8265	35.4069	40.1252	40.4550	46.7099	50.5621	54.7321 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7878	19.3517	15.7379	11.9146	8.9063	7.5191	8.1246	10.5607	14.1745	17.9978	21.0061	22.3934 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	75.8109	73.5553	68.8705	62.4985	58.3607	52.5369	47.5899	53.9317	56.1875	62.7821	70.2252	73.5647 (72)
Total internal gains	407.9795	405.8241	391.1341	367.3322	343.0103	319.6564	304.5306	310.7721	323.0332	347.0577	374.6848	395.5544 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	7.4200	11.2829	0.6300	0.7000	0.7700	25.5857 (75)
East	4.1400	19.6403	0.6300	0.7000	0.7700	24.8496 (76)
Southeast	1.8100	36.7938	0.6300	0.7000	0.7700	20.3529 (77)
Southwest	4.9100	36.7938	0.6300	0.7000	0.7700	55.2113 (79)
West	2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (80)

Solar gains	141.4855	259.6993	399.8896	561.8285	683.8159	701.2411	666.8806	573.5187	456.1600	299.5301	172.9957	118.7318 (83)
Total gains	549.4651	665.5234	791.0237	929.1607	1026.8262	1020.8975	971.4112	884.2909	779.1932	646.5877	547.6805	514.2863 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	16.2383	16.2824	16.3259	16.5332	16.5726	16.7584	16.7584	16.7933	16.6863	16.5726	16.4931	16.4108
alpha	2.0826	2.0855	2.0884	2.1022	2.1048	2.1172	2.1172	2.1196	2.1124	2.1048	2.0995	2.0941
util living area	0.9596	0.9394	0.9036	0.8366	0.7370	0.6101	0.4937	0.5425	0.7287	0.8805	0.9440	0.9644 (86)
MIT	17.7250	18.0714	18.6570	19.4172	20.0925	20.5864	20.8145	20.7665	20.3484	19.4552	18.4577	17.6681 (87)
Th 2	19.7227	19.7257	19.7286	19.7424	19.7450	19.7570	19.7570	19.7593	19.7524	19.7450	19.7397	19.7343 (88)
util rest of house	0.9534	0.9303	0.8885	0.8097	0.6902	0.5325	0.3824	0.4325	0.6625	0.8548	0.9340	0.9590 (89)
MIT 2	16.7681	17.1111	17.6874	18.4307	19.0633	19.5041	19.6766	19.6506	19.3167	18.4863	17.5069	16.7192 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	16.9142	17.2577	17.8354	18.5813	19.2204	19.6693	19.8503	19.8210	19.4742	18.6342	17.6520	16.8640 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.7642	17.1077	17.6854	18.4313	19.0704	19.5193	19.7003	19.6710	19.3242	18.4842	17.5020	16.7140 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9325	0.9039	0.8562	0.7746	0.6604	0.5156	0.3768	0.4236	0.6350	0.8205	0.9085	0.9399 (94)
Ext temp.	512.3579	601.5603	677.3006	719.7711	678.1650	526.3856	365.9996	374.5879	494.8058	530.5479	497.5708	483.3546 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1683.9479	1644.8269	1503.0657	1264.7319	975.6774	643.9816	405.8595	427.3116	686.8517	1043.6848	1383.6262	1672.9021 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	871.6630	701.0752	614.3692	392.3718	221.3492	0.0000	0.0000	0.0000	0.0000	381.7738	637.9599	885.0234 (98)
Space heating per m2												4705.5855 (98)
										(98) / (4) =		50.6195 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5199.5420	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	871.6630	701.0752	614.3692	392.3718	221.3492	0.0000	0.0000	0.0000	0.0000	381.7738	637.9599	885.0234	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	963.1635	774.6687	678.8610	433.5600	244.5848	0.0000	0.0000	0.0000	0.0000	421.8496	704.9280	977.9264	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129	(64)	
Efficiency of water heater (217)m	89.9536	89.9133	89.8278	89.6418	89.2657	87.3000	87.3000	87.3000	87.3000	89.6006	89.8547	89.9735	(216)	
Fuel for water heating, kWh/month	192.4793	168.8569	175.4495	154.7374	150.1879	134.1596	125.9455	142.2116	143.2255	160.6810	173.0062	186.8470	(219)	
Water heating fuel used												1907.7873	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5199.5420	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													384.7794	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.28 * 677 * 1.00) =										-692.7410			-692.7410	(233)
Total delivered energy for all uses													6874.3677	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5199.5420	0.2160	1123.1011	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.7873	0.2160	412.0821	(264)
Space and water heating			1535.1831	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	384.7794	0.5190	199.7005	(268)
Energy saving/generation technologies				
PV Unit	-692.7410	0.5190	-359.5326	(269)
Total CO2, kg/year			1414.2761	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER			15.2100	ZC1
Total Floor Area		TFA	92.9600	
Assumed number of occupants		N	2.6641	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.5806	ZC2
CO2 emissions from cooking, equation (L16)			1.9679	ZC3
Total CO2 emissions			32.7586	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			32.7586	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1276 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3776 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3776 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4814	0.4719	0.4625	0.4153	0.4059	0.3587	0.3587	0.3492	0.3776	0.4059	0.4248	0.4436 (22b)
Effective ac	0.6159	0.6114	0.6070	0.5862	0.5824	0.5643	0.5643	0.5610	0.5713	0.5824	0.5902	0.5984 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1600	1.0000	2.1600		(26)					
TER Opening Type (Uw = 1.40)			20.8600	1.3258	27.6553		(27)					
Heat Loss Floor			46.4800	0.1300	6.0424		(28a)					
External Wall	146.3900	23.0200	123.3700	0.1800	22.2066		(29a)					
External Roof	46.4800		46.4800	0.1300	6.0424		(30)					
Total net area of external elements Aum(A, m2)			239.3500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		64.1067		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2798 (36)					
Total fabric heat loss						(33) + (36) =	75.3865 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.7988	47.4496	47.1073	45.4996	45.1988	43.7986	43.7986	43.5393	44.3379	45.1988	45.8073	46.4435 (38)
Heat transfer coeff	123.1853	122.8361	122.4938	120.8861	120.5853	119.1851	119.1851	118.9258	119.7244	120.5853	121.1938	121.8300 (39)
Average = Sum(39)m / 12 =												120.8847 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3251	1.3214	1.3177	1.3004	1.2972	1.2821	1.2821	1.2793	1.2879	1.2972	1.3037	1.3106 (40)
HLP (average)												1.3004 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)										Total = Sum(45)m =		1533.6226 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.6644	47.1073	46.6907	43.2618	44.7038	46.6907	47.1073	50.6644	49.3151	50.9589 (61)
Solar input	209.9628	185.0932	194.1678	172.2171	166.7365	146.8522	140.6956	156.8426	158.5748	180.5690	191.1161	204.9457 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	209.9628	185.0932	194.1678	172.2171	166.7365	146.8522	140.6956	156.8426	158.5748	180.5690	191.1161	204.9457 (64)
Heat gains from water heating, kWh/month	65.6085	57.7462	60.3810	53.3758	51.5879	45.2593	43.0932	48.2982	48.8398	55.8594	59.4776	63.9403 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7878	19.3517	15.7379	11.9146	8.9063	7.5191	8.1246	10.5607	14.1745	17.9978	21.0061	22.3934	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	(71)
Water heating gains (Table 5)	88.1835	85.9319	81.1572	74.1331	69.3386	62.8601	57.9210	64.9169	67.8330	75.0798	82.6078	85.9413	(72)
Total internal gains	420.3521	418.2007	403.4208	378.9668	353.9882	329.9796	314.8616	321.7573	334.6787	359.3553	387.0674	407.9310	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					7.4200	11.2829	0.6300	0.7000			0.7700			25.5857 (75)
East					4.1400	19.6403	0.6300	0.7000			0.7700			24.8496 (76)
Southeast					1.8100	36.7938	0.6300	0.7000			0.7700			20.3529 (77)
Southwest					4.9100	36.7938	0.6300	0.7000			0.7700			55.2113 (79)
West					2.5800	19.6403	0.6300	0.7000			0.7700			15.4860 (80)
Solar gains	141.4855	259.6993	399.8896	561.8285	683.8159	701.2411	666.8806	573.5187	456.1600	299.5301	172.9957	118.7318	(83)	
Total gains	561.8376	677.9000	803.3104	940.7953	1037.8041	1031.2207	981.7422	895.2760	790.8386	658.8854	560.0632	526.6629	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4053	52.5542	52.7011	53.4020	53.5352	54.1641	54.1641	54.2822	53.9201	53.5352	53.2664	52.9882	
alpha	4.4937	4.5036	4.5134	4.5601	4.5690	4.6109	4.6109	4.6188	4.5947	4.5690	4.5511	4.5325	
util living area	0.9979	0.9947	0.9846	0.9478	0.8507	0.6809	0.5199	0.5850	0.8387	0.9742	0.9955	0.9984	(86)
MIT	19.5348	19.7231	20.0341	20.4385	20.7653	20.9402	20.9862	20.9770	20.8395	20.3977	19.8924	19.5071	(87)
Th 2	19.8212	19.8241	19.8270	19.8405	19.8430	19.8549	19.8549	19.8571	19.8503	19.8430	19.8379	19.8326	(88)
util rest of house	0.9971	0.9928	0.9789	0.9281	0.7970	0.5819	0.3918	0.4523	0.7601	0.9609	0.9937	0.9979	(89)
MIT 2	17.8828	18.1594	18.6121	19.1933	19.6200	19.8169	19.8502	19.8481	19.7242	19.1492	18.4169	17.8501	(90)
Living area fraction									fLA = Living area / (4) =			0.1526	(91)
MIT	18.1350	18.3981	18.8291	19.3833	19.7948	19.9884	20.0236	20.0204	19.8945	19.3398	18.6421	18.1030	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1350	18.3981	18.8291	19.3833	19.7948	19.9884	20.0236	20.0204	19.8945	19.3398	18.6421	18.1030	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9954	0.9894	0.9720	0.9182	0.7944	0.5943	0.4114	0.4723	0.7636	0.9527	0.9906	0.9965	(94)
Useful gains	559.2598	670.7107	780.8517	863.8015	824.4503	612.8695	403.8470	422.8362	603.9229	627.7268	554.8195	524.8391	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1704.2658	1658.0483	1510.2442	1267.2911	976.1150	642.2142	408.0390	430.5633	693.7396	1053.8905	1398.8323	1693.8026	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	851.8845	663.4908	542.6681	290.5125	112.8386	0.0000	0.0000	0.0000	0.0000	317.0658	607.6892	869.7089	(98)
Space heating												4255.8583	(98)
Space heating per m2												(98) / (4) =	45.7816 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4556.5935 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	851.8845	663.4908	542.6681	290.5125	112.8386	0.0000	0.0000	0.0000	0.0000	317.0658	607.6892	869.7089	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	912.0819	710.3756	581.0150	311.0412	120.8122	0.0000	0.0000	0.0000	0.0000	339.4709	650.6308	931.1658	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	209.9628	185.0932	194.1678	172.2171	166.7365	146.8522	140.6956	156.8426	158.5748	180.5690	191.1161	204.9457	(64)
Efficiency of water heater (217)m	88.2063	87.9861	87.4999	86.3575	84.0920	80.3000	80.3000	80.3000	80.3000	86.4543	87.7591	88.2824	(216)
Fuel for water heating, kWh/month	238.0361	210.3663	221.9064	199.4235	198.2787	182.8794	175.2124	195.3208	197.4779	208.8606	217.7736	232.1479	(219)
Water heating fuel used												2477.6837	(219)
Annual totals kWh/year													
Space heating fuel - main system												4556.5935	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												384.7794	(232)
Total delivered energy for all uses												7494.0566	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4556.5935	0.2160	984.2242 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2477.6837	0.2160	535.1797 (264)
Space and water heating			1519.4039 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	384.7794	0.5190	199.7005 (268)
Total CO2, kg/m2/year			1758.0294 (272)
Emissions per m2 for space and water heating			16.3447 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1482 (272b)
Emissions per m2 for pumps and fans			0.4187 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3447 * 1.00) + 2.1482 + 0.4187, rounded to 2 d.p.			18.9100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1276 (8)
Pressure test					Yes
Measured/design AP50					5.1800
Infiltration rate					0.3866 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4929	0.4832	0.4735	0.4252	0.4155	0.3672	0.3672	0.3576	0.3866	0.4155	0.4349	0.4542 (22b)
Effective ac	0.6215	0.6167	0.6121	0.5904	0.5863	0.5674	0.5674	0.5639	0.5747	0.5863	0.5946	0.6032 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			20.8600	1.3258	27.6553		(27)
Heat Loss Floor			46.4800	0.1700	7.9016	75.0000	3486.0000 (28a)
External Wall	146.3900	23.0200	123.3700	0.2000	24.6740	9.0000	1110.3300 (29a)
External Roof	46.4800		46.4800	0.1000	4.6480	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			239.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.9029		(33)
Internal Wall - GF			54.1900			9.0000	487.7100 (32c)
Internal Wall - FF			80.2400			9.0000	722.1600 (32c)
Internal Floor			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			9.0000	418.3200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7479.4800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							80.4591 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.9671 (36)
Total fabric heat loss						(33) + (36) =	86.8700 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.2326	47.8666	47.5078	45.8225	45.5072	44.0394	44.0394	43.7676	44.6048	45.5072	46.1451	46.8119 (38)
Heat transfer coeff	135.1026	134.7366	134.3778	132.6925	132.3772	130.9094	130.9094	130.6376	131.4748	132.3772	133.0151	133.6819 (39)
Average = Sum(39)m / 12 =												132.6910 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4533	1.4494	1.4455	1.4274	1.4240	1.4082	1.4082	1.4053	1.4143	1.4240	1.4309	1.4381 (40)
HLP (average)												1.4274 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)										Total = Sum(45)m =		1533.6226 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.7883	29.5515	30.4945	26.5858	25.5097	22.0130	20.3982	23.4073	23.6868	27.6047	30.1327	32.7222 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7878	19.3517	15.7379	11.9146	8.9063	7.5191	8.1246	10.5607	14.1745	17.9978	21.0061	22.3934	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	(71)
Water heating gains (Table 5)	45.4144	43.9754	40.9872	36.9248	34.2873	30.5736	27.4170	31.4614	32.8984	37.1031	41.8510	43.9814	(72)
Total internal gains	374.5830	373.2443	360.2508	338.7585	315.9369	294.6931	281.3576	285.3018	296.7441	318.3786	343.3106	362.9712	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					7.4200	11.2829	0.6300	0.7000			0.7700			25.5857 (75)
East					4.1400	19.6403	0.6300	0.7000			0.7700			24.8496 (76)
Southeast					1.8100	36.7938	0.6300	0.7000			0.7700			20.3529 (77)
Southwest					4.9100	36.7938	0.6300	0.7000			0.7700			55.2113 (79)
West					2.5800	19.6403	0.6300	0.7000			0.7700			15.4860 (80)
Solar gains	141.4855	259.6993	399.8896	561.8285	683.8159	701.2411	666.8806	573.5187	456.1600	299.5301	172.9957	118.7318	(83)	
Total gains	516.0686	632.9436	760.1404	900.5870	999.7528	995.9342	948.2382	858.8205	752.9040	617.9087	516.3064	481.7030	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	15.3782	15.4200	15.4611	15.6575	15.6948	15.8708	15.8708	15.9038	15.8025	15.6948	15.6195	15.5416	
alpha	2.0252	2.0280	2.0307	2.0438	2.0463	2.0581	2.0581	2.0603	2.0535	2.0463	2.0413	2.0361	
util living area	0.9607	0.9403	0.9043	0.8373	0.7386	0.6134	0.4982	0.5482	0.7328	0.8828	0.9456	0.9655	(86)
MIT	17.5749	17.9331	18.5396	19.3278	20.0313	20.5512	20.7951	20.7425	20.2987	19.3656	18.3311	17.5162	(87)
Th 2	19.7227	19.7257	19.7286	19.7424	19.7450	19.7570	19.7570	19.7593	19.7524	19.7450	19.7397	19.7343	(88)
util rest of house	0.9548	0.9315	0.8896	0.8110	0.6927	0.5368	0.3875	0.4391	0.6681	0.8581	0.9360	0.9603	(89)
MIT 2	16.6274	16.9824	17.5797	18.3514	19.0127	19.4793	19.6664	19.6371	19.2786	18.4072	17.3900	16.5767	(90)
Living area fraction									fLA = Living area / (4) =			0.1526	(91)
MIT	16.7720	17.1275	17.7262	18.5004	19.1682	19.6429	19.8387	19.8058	19.4343	18.5535	17.5337	16.7201	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7720	17.1275	17.7262	18.5004	19.1682	19.6429	19.8387	19.8058	19.4343	18.5535	17.5337	16.7201	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	482.5383	573.6607	652.9601	701.3419	667.8008	526.7318	375.0840	381.0813	488.1597	511.0573	470.9885	453.9021	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1685.0010	1647.4923	1508.5551	1273.9042	988.6176	660.1611	423.9780	444.9294	701.3272	1052.8632	1387.8342	1673.7091	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	894.6322	721.6148	636.5627	412.2449	238.6877	0.0000	0.0000	0.0000	0.0000	403.1036	660.1289	907.5364	(98)
Space heating												4874.5112	(98)
Space heating per m2												52.4367	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1230.5488	968.7299	992.8460	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6822	0.7436	0.7083	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	839.5117	720.3119	703.2265	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1264.9478	1207.0473	1104.2721	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	306.3139	362.1311	298.3779	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												966.8230 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	76.5785	90.5328	74.5945	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												241.7057 (107)
Space cooling per m2												2.6001 (108)
Energy for space heating												52.4367 (99)
Energy for space cooling												2.6001 (108)
Total												55.0368 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1276 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3776 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3776 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4814	0.4719	0.4625	0.4153	0.4059	0.3587	0.3587	0.3492	0.3776	0.4059	0.4248	0.4436 (22b)
Effective ac	0.6159	0.6114	0.6070	0.5862	0.5824	0.5643	0.5643	0.5610	0.5713	0.5824	0.5902	0.5984 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.40)			20.8600	1.3258	27.6553		(27)
Heat Loss Floor			46.4800	0.1300	6.0424		(28a)
External Wall	146.3900	23.0200	123.3700	0.1800	22.2066		(29a)
External Roof	46.4800		46.4800	0.1300	6.0424		(30)
Total net area of external elements Aum(A, m ²)			239.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.1067		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2798 (36)
Total fabric heat loss						(33) + (36) =	75.3865 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	47.7988	47.4496	47.1073	45.4996	45.1988	43.7986	43.7986	43.5393	44.3379	45.1988	45.8073	46.4435 (38)
Heat transfer coeff	123.1853	122.8361	122.4938	120.8861	120.5853	119.1851	119.1851	118.9258	119.7244	120.5853	121.1938	121.8300 (39)
Average = Sum(39)m / 12 =												120.8847 (39)
HLP	1.3251	1.3214	1.3177	1.3004	1.2972	1.2821	1.2821	1.2793	1.2879	1.2972	1.3037	1.3106 (40)
HLP (average)												1.3004 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)										Total = Sum(45)m =		1533.6226 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.7883	29.5515	30.4945	26.5858	25.5097	22.0130	20.3982	23.4073	23.6868	27.6047	30.1327	32.7222 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7878	19.3517	15.7379	11.9146	8.9063	7.5191	8.1246	10.5607	14.1745	17.9978	21.0061	22.3934	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	(71)
Water heating gains (Table 5)	45.4144	43.9754	40.9872	36.9248	34.2873	30.5736	27.4170	31.4614	32.8984	37.1031	41.8510	43.9814	(72)
Total internal gains	374.5830	373.2443	360.2508	338.7585	315.9369	294.6931	281.3576	285.3018	296.7441	318.3786	343.3106	362.9712	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					7.4200	11.2829	0.6300	0.7000	0.7700		25.5857 (75)	
East					4.1400	19.6403	0.6300	0.7000	0.7700		24.8496 (76)	
Southeast					1.8100	36.7938	0.6300	0.7000	0.7700		20.3529 (77)	
Southwest					4.9100	36.7938	0.6300	0.7000	0.7700		55.2113 (79)	
West					2.5800	19.6403	0.6300	0.7000	0.7700		15.4860 (80)	
Solar gains	141.4855	259.6993	399.8896	561.8285	683.8159	701.2411	666.8806	573.5187	456.1600	299.5301	172.9957	118.7318 (83)
Total gains	516.0686	632.9436	760.1404	900.5870	999.7528	995.9342	948.2382	858.8205	752.9040	617.9087	516.3064	481.7030 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4053	52.5542	52.7011	53.4020	53.5352	54.1641	54.1641	54.2822	53.9201	53.5352	53.2664	52.9882	
alpha	4.4937	4.5036	4.5134	4.5601	4.5690	4.6109	4.6109	4.6188	4.5947	4.5690	4.5511	4.5325	
util living area	0.9985	0.9960	0.9875	0.9549	0.8641	0.6984	0.5363	0.6057	0.8571	0.9796	0.9968	0.9989	(86)
MIT	19.4904	19.6801	19.9946	20.4073	20.7466	20.9336	20.9844	20.9735	20.8219	20.3617	19.8502	19.4633	(87)
Th 2	19.8212	19.8241	19.8270	19.8405	19.8430	19.8549	19.8549	19.8571	19.8503	19.8430	19.8379	19.8326	(88)
util rest of house	0.9980	0.9945	0.9828	0.9373	0.8130	0.5992	0.4052	0.4703	0.7827	0.9687	0.9954	0.9985	(89)
MIT 2	18.4535	18.6448	18.9590	19.3700	19.6766	19.8257	19.8512	19.8499	19.7526	19.3354	18.8259	18.4353	(90)
Living area fraction									fLA = Living area / (4) =			0.1526	(91)
MIT	18.6118	18.8028	19.1171	19.5284	19.8399	19.9948	20.0242	20.0214	19.9158	19.4920	18.9822	18.5922	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6118	18.8028	19.1171	19.5284	19.8399	19.9948	20.0242	20.0214	19.9158	19.4920	18.9822	18.5922	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9928	0.9789	0.9313	0.8128	0.6123	0.4253	0.4909	0.7877	0.9642	0.9940	0.9979	(94)
Ext temp.	514.6056	628.3646	744.1178	838.7280	812.6183	609.8354	403.3006	421.6345	593.0917	595.7790	513.1863	480.7021	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1762.9997	1707.7714	1545.5120	1284.8211	981.5582	642.9822	408.1084	430.6802	696.2922	1072.2480	1440.0522	1753.4006	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	928.8052	725.3614	596.2372	321.1870	125.6913	0.0000	0.0000	0.0000	0.0000	354.4929	667.3435	946.8877	(98)
Space heating per m2												4666.0062	(98)
												50.1937	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1120.3399	881.9697	903.8360	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8678	0.9235	0.8935	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	972.2020	814.4668	807.5415	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1264.9478	1207.0473	1104.2721	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	210.7769	292.0799	220.7676	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												723.6243 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	52.6942	73.0200	55.1919	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												180.9061 (107)
Space cooling per m2												1.9461 (108)
Energy for space heating												50.1937 (99)
Energy for space cooling												1.9461 (108)
Total												52.1398 (109)
Target Fabric Energy Efficiency (TFEE)												60.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1276 (8)
Pressure test					Yes
Measured/design AP50					5.1800
Infiltration rate					0.3866 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4252	0.3962	0.3962	0.3769	0.3769	0.3576	0.3576	0.3382	0.3382	0.3672	0.3576	0.3769 (22b)
Effective ac	0.5904	0.5785	0.5785	0.5710	0.5710	0.5639	0.5639	0.5572	0.5572	0.5674	0.5639	0.5710 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			20.8600	1.3258	27.6553		(27)
Heat Loss Floor			46.4800	0.1700	7.9016	75.0000	3486.0000 (28a)
External Wall	146.3900	23.0200	123.3700	0.2000	24.6740	9.0000	1110.3300 (29a)
External Roof	46.4800		46.4800	0.1000	4.6480	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			239.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.9029		(33)
Internal Wall - GF			54.1900			9.0000	487.7100 (32c)
Internal Wall - FF			80.2400			9.0000	722.1600 (32c)
Internal Floor			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7897.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 84.9591 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.9671 (36)
Total fabric heat loss (33) + (36) = 86.8700 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	45.8225	44.8984	44.8984	44.3185	44.3185	43.7676	43.7676	43.2458	43.2458	44.0394	43.7676	44.3185 (38)
Heat transfer coeff	132.6925	131.7684	131.7684	131.1885	131.1885	130.6376	130.6376	130.1158	130.1158	130.9094	130.6376	131.1885 (39)
Average = Sum(39)m / 12 =												131.0707 (39)
HLP	1.4274	1.4175	1.4175	1.4112	1.4112	1.4053	1.4053	1.3997	1.3997	1.4082	1.4053	1.4112 (40)
HLP (average)												1.4100 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1533.6226 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1382	12.7590	14.0990	13.5996	14.0205	13.5309	13.9587	13.9988	13.5683	14.0665	13.6531	14.1261 (61)
Total heat required for water heating calculated for each month	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.4033	49.4291	51.2396	44.9989	43.4204	37.8265	35.4069	40.1252	40.4550	46.7099	50.5621	54.7321 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.4695	48.3793	39.3447	29.7865	22.2657	18.7977	20.3116	26.4017	35.4363	44.9946	52.5153	55.9834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	75.8109	73.5553	68.8705	62.4985	58.3607	52.5369	47.5899	53.9317	56.1875	62.7821	70.2252	73.5647 (72)
Total internal gains	605.0161	600.4558	577.1970	540.9584	503.6644	470.2786	450.7494	459.3959	480.2257	516.6868	557.2862	588.1876 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				7.4200	14.6176	0.6300		0.7000	0.7700		33.1477 (75)	
East				4.1400	25.1925	0.6300		0.7000	0.7700		31.8746 (76)	
Southeast				1.8100	45.1778	0.6300		0.7000	0.7700		24.9905 (77)	
Southwest				4.9100	45.1778	0.6300		0.7000	0.7700		67.7920 (79)	
West				2.5800	25.1925	0.6300		0.7000	0.7700		19.8639 (80)	
Solar gains	177.6687	278.3713	433.8299	615.1892	708.9700	797.2911	731.4662	655.9836	519.5627	342.5420	216.7123	141.0215 (83)
Total gains	782.6848	878.8271	1011.0269	1156.1477	1212.6344	1267.5697	1182.2156	1115.3794	999.7884	859.2288	773.9985	729.2091 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.5332	16.6492	16.6492	16.7228	16.7228	16.7933	16.7933	16.8606	16.8606	16.7584	16.7933	16.7228
alpha	2.1022	2.1099	2.1099	2.1149	2.1149	2.1196	2.1196	2.1240	2.1240	2.1172	2.1196	2.1149
util living area	0.9154	0.8919	0.8399	0.7505	0.6243	0.4519	0.3361	0.3521	0.5744	0.7784	0.8817	0.9235 (86)
MIT	18.4132	18.6876	19.2425	19.8942	20.4632	20.8201	20.9350	20.9293	20.6770	20.0201	19.1444	18.3864 (87)
Th 2	19.7424	19.7500	19.7500	19.7547	19.7547	19.7593	19.7593	19.7636	19.7636	19.7570	19.7593	19.7547 (88)
util rest of house	0.9029	0.8763	0.8163	0.7127	0.5629	0.3618	0.2199	0.2317	0.4869	0.7339	0.8614	0.9121 (89)
MIT 2	17.4559	17.7271	18.2625	18.8790	19.3887	19.6715	19.7417	19.7442	19.5822	19.0166	18.1855	17.4390 (90)
Living area fraction									fLA = Living area / (4) =			0.1526 (91)
MIT	17.6020	17.8737	18.4121	19.0339	19.5527	19.8468	19.9239	19.9251	19.7493	19.1698	18.3319	17.5836 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4520	17.7237	18.2621	18.8839	19.4027	19.6968	19.7739	19.7751	19.5993	19.0198	18.1819	17.4336 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8724	0.8434	0.7814	0.6817	0.5433	0.3569	0.2213	0.2330	0.4737	0.7017	0.8277	0.8830 (94)
Ext temp.	5.4000	5.9000	7.0000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1599.2119	1557.9918	1404.9244	1165.4707	826.8408	496.0052	270.9274	270.0081	559.4060	918.9575	1277.8788	1565.5563 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	681.7941	548.9055	457.5014	271.6908	124.9979	0.0000	0.0000	0.0000	0.0000	235.1176	458.8121	685.7147 (98)
Space heating												3464.5340 (98)
RHI space heating demand												3465 (98)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1276 (8)				
Pressure test							Yes					
Measured/design AP50							5.1800					
Infiltration rate							0.3866	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3866 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4929	0.4832	0.4735	0.4252	0.4155	0.3672	0.3672	0.3576	0.3866	0.4155	0.4349	0.4542 (22b)
Effective ac	0.6215	0.6167	0.6121	0.5904	0.5863	0.5674	0.5674	0.5639	0.5747	0.5863	0.5946	0.6032 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Doors			2.1600	1.4000	3.0240			(26)					
Windows (Uw = 1.40)			20.8600	1.3258	27.6553			(27)					
Heat Loss Floor			46.4800	0.1700	7.9016	75.0000	3486.0000	(28a)					
External Wall	146.3900	23.0200	123.3700	0.2000	24.6740	9.0000	1110.3300	(29a)					
External Roof	46.4800		46.4800	0.1000	4.6480	9.0000	418.3200	(30)					
Total net area of external elements Aum(A, m2)			239.3500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.9029			(33)					
Internal Wall - GF			54.1900			9.0000	487.7100	(32c)					
Internal Wall - FF			80.2400			9.0000	722.1600	(32c)					
Internal Floor			46.4800			18.0000	836.6400	(32d)					
Internal Ceiling			46.4800			18.0000	836.6400	(32e)					
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) =					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								7897.8000 (34)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								84.9591 (35)					
Total fabric heat loss								18.9671 (36)					
								(33) + (36) =					
								86.8700 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	48.2326	47.8666	47.5078	45.8225	45.5072	44.0394	44.0394	43.7676	44.6048	45.5072	46.1451	46.8119	(38)
Heat transfer coeff	135.1026	134.7366	134.3778	132.6925	132.3772	130.9094	130.9094	130.6376	131.4748	132.3772	133.0151	133.6819	(39)
Average = Sum(39)m / 12 =												132.6910	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4533	1.4494	1.4455	1.4274	1.4240	1.4082	1.4082	1.4053	1.4143	1.4240	1.4309	1.4381	(40)
HLP (average)												1.4274	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	Jan 107.2198	Feb 103.3209	Mar 99.4220	Apr 95.5231	May 91.6242	Jun 87.7253	Jul 87.7253	Aug 91.6242	Sep 95.5231	Oct 99.4220	Nov 103.3209	Dec 107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)												Total = Sum(45)m = 1533.6226 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1382	12.7590	14.0990	13.5996	14.0205	13.5309	13.9587	13.9988	13.5683	14.0665	13.6531	14.1261 (61)
Total heat required for water heating calculated for each month	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (64)
Heat gains from water heating, kWh/month	56.4033	49.4291	51.2396	44.9989	43.4204	37.8265	35.4069	40.1252	40.4550	46.7099	50.5621	54.7321 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.4695	48.3793	39.3447	29.7865	22.2657	18.7977	20.3116	26.4017	35.4363	44.9946	52.5153	55.9834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	75.8109	73.5553	68.8705	62.4985	58.3607	52.5369	47.5899	53.9317	56.1875	62.7821	70.2252	73.5647 (72)
Total internal gains	605.0161	600.4558	577.1970	540.9584	503.6644	470.2786	450.7494	459.3959	480.2257	516.6868	557.2862	588.1876 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	7.4200	11.2829	0.6300	0.7000	0.7700	25.5857 (75)
East	4.1400	19.6403	0.6300	0.7000	0.7700	24.8496 (76)
Southeast	1.8100	36.7938	0.6300	0.7000	0.7700	20.3529 (77)
Southwest	4.9100	36.7938	0.6300	0.7000	0.7700	55.2113 (79)
West	2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (80)

Solar gains	141.4855	259.6993	399.8896	561.8285	683.8159	701.2411	666.8806	573.5187	456.1600	299.5301	172.9957	118.7318 (83)
Total gains	746.5016	860.1551	977.0866	1102.7869	1187.4803	1171.5197	1117.6300	1032.9146	936.3857	816.2169	730.2819	706.9194 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	16.2383	16.2824	16.3259	16.5332	16.5726	16.7584	16.7584	16.7933	16.6863	16.5726	16.4931	16.4108
alpha	2.0826	2.0855	2.0884	2.1022	2.1048	2.1172	2.1172	2.1196	2.1124	2.1048	2.0995	2.0941
util living area	0.9309	0.9070	0.8662	0.7934	0.6901	0.5607	0.4451	0.4871	0.6679	0.8312	0.9088	0.9374 (86)
MIT	18.0426	18.3652	18.9068	19.6037	20.2124	20.6518	20.8489	20.8117	20.4591	19.6640	18.7377	17.9854 (87)
Th 2	19.7227	19.7257	19.7286	19.7424	19.7450	19.7570	19.7570	19.7593	19.7524	19.7450	19.7397	19.7343 (88)
util rest of house	0.9210	0.8939	0.8468	0.7623	0.6404	0.4836	0.3401	0.3821	0.5977	0.7987	0.8938	0.9284 (89)
MIT 2	17.0782	17.3952	17.9239	18.5995	19.1622	19.5483	19.6932	19.6742	19.4001	18.6761	17.7764	17.0298 (90)
Living area fraction	17.2254	17.5433	18.0740	18.7528	19.3225	19.7167	19.8696	19.8478	19.5618	18.8269	17.9231	17.1756 (91)
MIT	17.2254	17.5433	18.0740	18.7528	19.3225	19.7167	19.8696	19.8478	19.5618	18.8269	17.9231	17.1756 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0754	17.3933	17.9240	18.6028	19.1725	19.5667	19.7196	19.6978	19.4118	18.6769	17.7731	17.0256 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	666.5146	741.5031	793.2933	803.2870	729.4559	551.2206	376.2398	388.7159	538.7652	623.4436	629.6320	637.4622 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1725.9883	1683.2992	1535.1263	1287.4893	989.1929	650.1885	408.3841	430.8183	698.3650	1069.1923	1419.6867	1714.5549 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	788.2484	632.8869	551.9238	348.6256	193.2443	0.0000	0.0000	0.0000	0.0000	331.6371	568.8394	801.3570 (98)
Space heating												4216.7626 (98)
Space heating per m2												45.3610 (99)

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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4659.4062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	788.2484	632.8869	551.9238	348.6256	193.2443	0.0000	0.0000	0.0000	0.0000	331.6371	568.8394	801.3570	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	870.9927	699.3226	609.8605	385.2217	213.5297	0.0000	0.0000	0.0000	0.0000	366.4498	628.5518	885.4773	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129	(64)
Efficiency of water heater (217)m	89.9065	89.8627	89.7691	89.5656	89.1613	87.3000	87.3000	87.3000	87.3000	89.5068	89.7936	89.9284	(216)
Fuel for water heating, kWh/month	192.5801	168.9520	175.5642	154.8691	150.3638	134.1596	125.9455	142.2116	143.2255	160.8493	173.1239	186.9408	(219)
Water heating fuel used													1908.7854 (219)
Annual totals kWh/year													
Space heating fuel - main system													4659.4062 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													384.7794 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 677 * 1.00) =										-692.7410			-692.7410 (233)
Total delivered energy for all uses													6335.2300 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4659.4062	3.4800	162.1473 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1908.7854	3.4800	66.4257 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	384.7794	13.1900	50.7524 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-692.7410	13.1900	-91.3725 (252)
Total energy cost			317.8454 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9676 (257)
SAP value		86.5015
SAP rating (Section 12)		87 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4659.4062	0.2160	1006.4317 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1908.7854	0.2160	412.2976 (264)
Space and water heating			1418.7294 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	384.7794	0.5190	199.7005 (268)
Energy saving/generation technologies			
PV Unit	-692.7410	0.5190	-359.5326 (269)
Total kg/year			1297.8223 (272)
CO2 emissions per m2			13.9600 (273)
EI value			87.3943
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8889 = 3.915$, stars = 4
Water heating environmental impact	$0.216 / 0.8889 = 0.2430$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1276 (8)				
Pressure test							Yes					
Measured/design AP50								5.1800				
Infiltration rate								0.3866 (18)				
Number of sides sheltered								0 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3866 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4252	0.3962	0.3962	0.3769	0.3769	0.3576	0.3576	0.3382	0.3382	0.3672	0.3576	0.3769 (22b)
Effective ac	0.5904	0.5785	0.5785	0.5710	0.5710	0.5639	0.5639	0.5572	0.5572	0.5674	0.5639	0.5710 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Doors			2.1600	1.4000	3.0240		(26)					
Windows (Uw = 1.40)			20.8600	1.3258	27.6553		(27)					
Heat Loss Floor			46.4800	0.1700	7.9016	75.0000	3486.0000 (28a)					
External Wall	146.3900	23.0200	123.3700	0.2000	24.6740	9.0000	1110.3300 (29a)					
External Roof	46.4800		46.4800	0.1000	4.6480	9.0000	418.3200 (30)					
Total net area of external elements Aum(A, m2)			239.3500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.9029		(33)					
Internal Wall - GF			54.1900			9.0000	487.7100 (32c)					
Internal Wall - FF			80.2400			9.0000	722.1600 (32c)					
Internal Floor			46.4800			18.0000	836.6400 (32d)					
Internal Ceiling			46.4800			18.0000	836.6400 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7897.8000 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							84.9591 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.9671 (36)					
Total fabric heat loss						(33) + (36) =	86.8700 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.8225	Feb 44.8984	Mar 44.8984	Apr 44.3185	May 44.3185	Jun 43.7676	Jul 43.7676	Aug 43.2458	Sep 43.2458	Oct 44.0394	Nov 43.7676	Dec 44.3185 (38)
Heat transfer coeff	132.6925	131.7684	131.7684	131.1885	131.1885	130.6376	130.6376	130.1158	130.1158	130.9094	130.6376	131.1885 (39)
Average = Sum(39)m / 12 =												131.0707 (39)
HLP	Jan 1.4274	Feb 1.4175	Mar 1.4175	Apr 1.4112	May 1.4112	Jun 1.4053	Jul 1.4053	Aug 1.3997	Sep 1.3997	Oct 1.4082	Nov 1.4053	Dec 1.4112 (40)
HLP (average)												1.4100 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	Jan 107.2198	Feb 103.3209	Mar 99.4220	Apr 95.5231	May 91.6242	Jun 87.7253	Jul 87.7253	Aug 91.6242	Sep 95.5231	Oct 99.4220	Nov 103.3209	Dec 107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)												Total = Sum(45)m = 1533.6226 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1382	12.7590	14.0990	13.5996	14.0205	13.5309	13.9587	13.9988	13.5683	14.0665	13.6531	14.1261 (61)
Total heat required for water heating calculated for each month	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (64)
Heat gains from water heating, kWh/month	56.4033	49.4291	51.2396	44.9989	43.4204	37.8265	35.4069	40.1252	40.4550	46.7099	50.5621	54.7321 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.4695	48.3793	39.3447	29.7865	22.2657	18.7977	20.3116	26.4017	35.4363	44.9946	52.5153	55.9834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	(71)
Water heating gains (Table 5)	75.8109	73.5553	68.8705	62.4985	58.3607	52.5369	47.5899	53.9317	56.1875	62.7821	70.2252	73.5647	(72)
Total internal gains	605.0161	600.4558	577.1970	540.9584	503.6644	470.2786	450.7494	459.3959	480.2257	516.6868	557.2862	588.1876	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
Northeast					7.4200	14.6176	0.6300	0.7000				0.7700			33.1477 (75)
East					4.1400	25.1925	0.6300	0.7000				0.7700			31.8746 (76)
Southeast					1.8100	45.1778	0.6300	0.7000				0.7700			24.9905 (77)
Southwest					4.9100	45.1778	0.6300	0.7000				0.7700			67.7920 (79)
West					2.5800	25.1925	0.6300	0.7000				0.7700			19.8639 (80)
Solar gains	177.6687	278.3713	433.8299	615.1892	708.9700	797.2911	731.4662	655.9836	519.5627	342.5420	216.7123			141.0215 (83)	
Total gains	782.6848	878.8271	1011.0269	1156.1477	1212.6344	1267.5697	1182.2156	1115.3794	999.7884	859.2288	773.9985			729.2091 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.5332	16.6492	16.6492	16.7228	16.7228	16.7933	16.7933	16.8606	16.8606	16.7584	16.7933	16.7228	
alpha	2.1022	2.1099	2.1099	2.1149	2.1149	2.1196	2.1196	2.1240	2.1240	2.1172	2.1196	2.1149	
util living area	0.9154	0.8919	0.8399	0.7505	0.6243	0.4519	0.3361	0.3521	0.5744	0.7784	0.8817	0.9235	(86)
MIT	18.4132	18.6876	19.2425	19.8942	20.4632	20.8201	20.9350	20.9293	20.6770	20.0201	19.1444	18.3864	(87)
Th 2	19.7424	19.7500	19.7500	19.7547	19.7547	19.7593	19.7593	19.7636	19.7636	19.7570	19.7593	19.7547	(88)
util rest of house	0.9029	0.8763	0.8163	0.7127	0.5629	0.3618	0.2199	0.2317	0.4869	0.7339	0.8614	0.9121	(89)
MIT 2	17.4559	17.7271	18.2625	18.8790	19.3887	19.6715	19.7417	19.7442	19.5822	19.0166	18.1855	17.4390	(90)
Living area fraction	17.6020	17.8737	18.4121	19.0339	19.5527	19.8468	19.9239	19.9251	19.7493	19.1698	18.3319	17.5836	(91)
MIT	17.6020	17.8737	18.4121	19.0339	19.5527	19.8468	19.9239	19.9251	19.7493	19.1698	18.3319	17.5836	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4520	17.7237	18.2621	18.8839	19.4027	19.6968	19.7739	19.7751	19.5993	19.0198	18.1819	17.4336	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8724	0.8434	0.7814	0.6817	0.5433	0.3569	0.2213	0.2330	0.4737	0.7017	0.8277	0.8830	(94)
Ext temp.	682.8219	741.1682	790.0033	788.1224	658.8329	452.3430	261.6370	259.8294	473.6473	602.9392	640.6398	643.8968	(95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Month fracti	1599.2119	1557.9918	1404.9244	1165.4707	826.8408	496.0052	270.9274	270.0081	559.4060	918.9575	1277.8788	1565.5563	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	681.7941	548.9055	457.5014	271.6908	124.9979	0.0000	0.0000	0.0000	0.0000	235.1176	458.8121	685.7147	(98)
Space heating per m2												3464.5340	(98)
												37.2691	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3828.2143	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	681.7941	548.9055	457.5014	271.6908	124.9979	0.0000	0.0000	0.0000	0.0000	235.1176	458.8121	685.7147	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	753.3637	606.5254	505.5264	300.2108	138.1192	0.0000	0.0000	0.0000	0.0000	259.7984	506.9747	757.6958	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129	(64)	
Efficiency of water heater (217)m	89.8331	89.7869	89.6579	89.3925	88.8152	87.3000	87.3000	87.3000	87.3000	89.2574	89.6682	89.8515	(216)	
Fuel for water heating, kWh/month	192.7374	169.0946	175.7819	155.1689	150.9497	134.1596	125.9455	142.2116	143.2255	161.2987	173.3660	187.1007	(219)	
Water heating fuel used												1911.0400	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3828.2143	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													384.7794	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.28 * 776 * 1.00) =										-794.4149			-794.4149	(233)
Total delivered energy for all uses													5404.6188	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3828.2143	9.7400	372.8681	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1911.0400	9.7400	186.1353	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	384.7794	36.8500	141.7912	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-794.4149	36.8500	-292.7419	(252)
Total energy cost			539.6902	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3828.2143	0.2160	826.8943	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.0400	0.2160	412.7846	(264)
Space and water heating			1239.6789	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	384.7794	0.5190	199.7005	(268)
Energy saving/generation technologies				
PV Unit	-794.4149	0.5190	-412.3013	(269)
Total kg/year			1066.0031	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3828.2143	1.2200	4670.4215	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.0400	1.2200	2331.4688	(264)
Space and water heating			7001.8903	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	384.7794	3.0700	1181.2726	(268)
Energy saving/generation technologies				
PV Unit	-794.4149	3.0700	-2438.8536	(269)
Primary energy kWh/year			5974.5593	(272)
Primary energy kWh/m2/year			64.2702	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 87

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 79	-190 kg (17.9%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£79	2.05 kg/m²	B 88	B 89
Total Savings	£79	2.05 kg/m²		
Potential energy efficiency rating:			B 88	
Potential environmental impact rating:				B 89

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£169	£188	-£18
Mains gas	£663	£565	£98
Space heating	£505	£505	£0
Water heating	£186	£107	£79
Lighting	£142	£142	£0
Generated (PV)	-£293	-£293	£0
Total cost of fuels	£539	£460	£80
Total cost of uses	£540	£461	£79
Delivered energy	58 kWh/m²	48 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	64 kWh/m²	53 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1276 (8)
Pressure test					Yes
Measured/design AP50					5.1800
Infiltration rate					0.3866 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4929	0.4832	0.4735	0.4252	0.4155	0.3672	0.3672	0.3576	0.3866	0.4155	0.4349	0.4542 (22b)
Effective ac	0.6215	0.6167	0.6121	0.5904	0.5863	0.5674	0.5674	0.5639	0.5747	0.5863	0.5946	0.6032 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			20.8600	1.3258	27.6553		(27)
Heat Loss Floor			46.4800	0.1700	7.9016	75.0000	3486.0000 (28a)
External Wall	146.3900	23.0200	123.3700	0.2000	24.6740	9.0000	1110.3300 (29a)
External Roof	46.4800		46.4800	0.1000	4.6480	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			239.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.9029		(33)
Internal Wall - GF			54.1900			9.0000	487.7100 (32c)
Internal Wall - FF			80.2400			9.0000	722.1600 (32c)
Internal Floor			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7897.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 84.9591 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.9671 (36)
Total fabric heat loss (33) + (36) = 86.8700 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.2326	47.8666	47.5078	45.8225	45.5072	44.0394	44.0394	43.7676	44.6048	45.5072	46.1451	46.8119 (38)
Heat transfer coeff	135.1026	134.7366	134.3778	132.6925	132.3772	130.9094	130.9094	130.6376	131.4748	132.3772	133.0151	133.6819 (39)
Average = Sum(39)m / 12 =												132.6910 (39)
HLP	1.4533	1.4494	1.4455	1.4274	1.4240	1.4082	1.4082	1.4053	1.4143	1.4240	1.4309	1.4381 (40)
HLP (average)												1.4274 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m												1533.6226 (45)

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	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1382	12.7590	14.0990	13.5996	14.0205	13.5309	13.9587	13.9988	13.5683	14.0665	13.6531	14.1261 (61)
Total heat required for water heating calculated for each month	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (62)
Aperture area of solar collector												168.1129 (H1)
Zero-loss collector efficiency												3.0000 (H2)
Collector heat loss coefficient												0.7000 (H3)
Collector 2nd order heat loss coefficient												1.8000 (H3a)
Collector effective heat loss coefficient												0.0050 (H3b)
Collector performance ratio												1.8063 (H4)
Annual solar radiation per m2												2.5804 (H5)
Overshading factor												1079.5246 (H6)
Solar energy available												0.8000 (H7)
Adjustment factor for showers												1813.6014 (H7a)
Solar-to-load ratio												1.0000 (H8)
Utilisation factor												1.1826 (H9)
Collector performance factor												0.5707 (H10)
Dedicated solar storage volume												0.8793 (H11)
Effective solar volume												75.0000 (H12)
Daily hot water demand												75.0000 (H13)
Volume ratio Veff/V												97.4725 (H14)
Solar storage volume factor												0.7694 (H15)
Solar input												0.9476 (H16)
Solar input	-25.0079	-41.7310	-71.0726	-95.2513	-117.6749	-115.6932	-114.1643	-99.7459	-78.1210	-53.3475	-29.6629	-862.3999 (H17)
Output from w/h	148.1341	110.0939	86.5298	43.4581	16.3914	1.4281	0.0000	24.4048	46.9148	90.6237	125.7912	147.1856 (64)
Heat gains from water heating, kWh/month	56.4033	49.4291	51.2396	44.9989	43.4204	37.8265	35.4069	40.1252	40.4550	46.7099	50.5621	54.7321 (65)
												840.9554 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.4695	48.3793	39.3447	29.7865	22.2657	18.7977	20.3116	26.4017	35.4363	44.9946	52.5153	55.9834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	75.8109	73.5553	68.8705	62.4985	58.3607	52.5369	47.5899	53.9317	56.1875	62.7821	70.2252	73.5647 (72)
Total internal gains	605.0161	600.4558	577.1970	540.9584	503.6644	470.2786	450.7494	459.3959	480.2257	516.6868	557.2862	588.1876 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					7.4200	11.2829		0.6300	0.7000	0.7700		25.5857 (75)	
East					4.1400	19.6403		0.6300	0.7000	0.7700		24.8496 (76)	
Southeast					1.8100	36.7938		0.6300	0.7000	0.7700		20.3529 (77)	
Southwest					4.9100	36.7938		0.6300	0.7000	0.7700		55.2113 (79)	
West					2.5800	19.6403		0.6300	0.7000	0.7700		15.4860 (80)	
Solar gains	141.4855	259.6993	399.8896	561.8285	683.8159	701.2411	666.8806	573.5187	456.1600	299.5301	172.9957	118.7318	(83)
Total gains	746.5016	860.1551	977.0866	1102.7869	1187.4803	1171.5197	1117.6300	1032.9146	936.3857	816.2169	730.2819	706.9194	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.2383	16.2824	16.3259	16.5332	16.5726	16.7584	16.7584	16.7933	16.6863	16.5726	16.4931	16.4108
alpha	2.0826	2.0855	2.0884	2.1022	2.1048	2.1172	2.1172	2.1196	2.1124	2.1048	2.0995	2.0941
util living area	0.9309	0.9070	0.8662	0.7934	0.6901	0.5607	0.4451	0.4871	0.6679	0.8312	0.9088	0.9374 (86)
MIT	18.0426	18.3652	18.9068	19.6037	20.2124	20.6518	20.8489	20.8117	20.4591	19.6640	18.7377	17.9854 (87)
Th 2	19.7227	19.7257	19.7286	19.7424	19.7450	19.7570	19.7570	19.7593	19.7524	19.7450	19.7397	19.7343 (88)
util rest of house	0.9210	0.8939	0.8468	0.7623	0.6404	0.4836	0.3401	0.3821	0.5977	0.7987	0.8938	0.9284 (89)
MIT 2	17.0782	17.3952	17.9239	18.5995	19.1622	19.5483	19.6932	19.6742	19.4001	18.6761	17.7764	17.0298 (90)
Living area fraction	17.2254	17.5433	18.0740	18.7528	19.3225	19.7167	19.8696	19.8478	19.5618	18.8269	17.9231	17.1756 (91)
MIT	17.2254	17.5433	18.0740	18.7528	19.3225	19.7167	19.8696	19.8478	19.5618	18.8269	17.9231	17.1756 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0754	17.3933	17.9240	18.6028	19.1725	19.5667	19.7196	19.6978	19.4118	18.6769	17.7731	17.0256 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8929	0.8621	0.8119	0.7284	0.6143	0.4705	0.3366	0.3763	0.5754	0.7638	0.8622	0.9017	(94)
Useful gains	666.5146	741.5031	793.2933	803.2870	729.4559	551.2206	376.2398	388.7159	538.7652	623.4436	629.6320	637.4622	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1725.9883	1683.2992	1535.1263	1287.4893	989.1929	650.1885	408.3841	430.8183	698.3650	1069.1923	1419.6867	1714.5549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	788.2484	632.8869	551.9238	348.6256	193.2443	0.0000	0.0000	0.0000	0.0000	331.6371	568.8394	801.3570	(98)
Space heating												4216.7626	(98)
Space heating per m2											(98) / (4) =	45.3610	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4659.4062	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	788.2484	632.8869	551.9238	348.6256	193.2443	0.0000	0.0000	0.0000	0.0000	331.6371	568.8394	801.3570	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	870.9927	699.3226	609.8605	385.2217	213.5297	0.0000	0.0000	0.0000	0.0000	366.4498	628.5518	885.4773	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	148.1341	110.0939	86.5298	43.4581	16.3914	1.4281	0.0000	24.4048	46.9148	90.6237	125.7912	147.1856	(64)	
Efficiency of water heater	89.9782	90.0111	90.0526	90.1338	90.2414	87.3000	87.3000	87.3000	87.3000	89.7936	89.9032	89.9882	(217)	
Fuel for water heating, kWh/month	164.6333	122.3114	96.0881	48.2151	18.1640	1.6358	0.0000	27.9551	53.7397	100.9244	139.9185	163.5610	(219)	
Water heating fuel used												937.1464	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4659.4062	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													384.7794	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.28 * 677 * 1.00) =										-692.7410			-692.7410	(233)
Total delivered energy for all uses													5413.5910	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4659.4062	3.4800	162.1473 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	937.1464	3.4800	32.6127 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	384.7794	13.1900	50.7524 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-692.7410	13.1900	-91.3725 (252)
Total energy cost			290.6274 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8848 (257)
SAP value		87.6574
SAP rating (Section 12)		88 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4659.4062	0.2160	1006.4317	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.1464	0.2160	202.4236	(264)
Space and water heating			1208.8554	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	384.7794	0.5190	199.7005	(268)
Energy saving/generation technologies				
PV Unit	-692.7410	0.5190	-359.5326	(269)
Total kg/year			1113.8983	(272)
CO2 emissions per m2			11.9800	(273)
EI value			89.1808	
EI rating			89	(274)
EI band			B	

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.4000 (2b)	= 111.5520 (1b) - (3b)
First floor	46.4800 (1c)	x 2.6600 (2c)	= 123.6368 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.1888 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1276 (8)
Pressure test					Yes
Measured/design AP50					5.1800
Infiltration rate					0.3866 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4252	0.3962	0.3962	0.3769	0.3769	0.3576	0.3576	0.3382	0.3382	0.3672	0.3576	0.3769 (22b)
Effective ac	0.5904	0.5785	0.5785	0.5710	0.5710	0.5639	0.5639	0.5572	0.5572	0.5674	0.5639	0.5710 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			20.8600	1.3258	27.6553		(27)
Heat Loss Floor			46.4800	0.1700	7.9016	75.0000	3486.0000 (28a)
External Wall	146.3900	23.0200	123.3700	0.2000	24.6740	9.0000	1110.3300 (29a)
External Roof	46.4800		46.4800	0.1000	4.6480	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			239.3500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.9029		(33)
Internal Wall - GF			54.1900			9.0000	487.7100 (32c)
Internal Wall - FF			80.2400			9.0000	722.1600 (32c)
Internal Floor			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Total fabric heat loss (28)...(30) + (32) + (32a)...(32e) = 7897.8000 (34)
 (33) + (36) = 86.8700 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	45.8225	44.8984	44.8984	44.3185	44.3185	43.7676	43.7676	43.2458	43.2458	44.0394	43.7676	44.3185 (38)
Heat transfer coeff	132.6925	131.7684	131.7684	131.1885	131.1885	130.6376	130.6376	130.1158	130.1158	130.9094	130.6376	131.1885 (39)
Average = Sum(39)m / 12 =												131.0707 (39)
HLP	1.4274	1.4175	1.4175	1.4112	1.4112	1.4053	1.4053	1.3997	1.3997	1.4082	1.4053	1.4112 (40)
HLP (average)												1.4100 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m												1533.6226 (45)

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	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1382	12.7590	14.0990	13.5996	14.0205	13.5309	13.9587	13.9988	13.5683	14.0665	13.6531	14.1261 (61)
Total heat required for water heating calculated for each month	173.1420	151.8248	157.6024	138.7094	134.0663	117.1213	109.9504	124.1507	125.0358	143.9711	155.4542	168.1129 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3152 (H8)
Utilisation factor												0.5325 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4725 (H14)
Volume ratio Veff/V												0.7694 (H15)
Solar storage volume factor												0.9476 (H16)
Solar input	-29.3775	-41.7730	-71.7977	-96.8718	-113.2184	-122.0699	-116.2010	-105.9096	-82.7579	-56.9133	-34.7459	-894.8981 (H17)
Solar input												-23.2622 (63)
Solar input (sum of months) = Sum (63)m =												-894.8981 (63)
Output from w/h	143.7645	110.0518	85.8047	41.8376	20.8479	0.0000	0.0000	18.2411	42.2779	87.0578	120.7083	144.8507 (64)
Total per year (kWh/year) = Sum (64)m =												815.4424 (64)
Heat gains from water heating, kWh/month	56.4033	49.4291	51.2396	44.9989	43.4204	37.8265	35.4069	40.1252	40.4550	46.7099	50.5621	54.7321 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.4695	48.3793	39.3447	29.7865	22.2657	18.7977	20.3116	26.4017	35.4363	44.9946	52.5153	55.9834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	(71)
Water heating gains (Table 5)	75.8109	73.5553	68.8705	62.4985	58.3607	52.5369	47.5899	53.9317	56.1875	62.7821	70.2252	73.5647	(72)
Total internal gains	605.0161	600.4558	577.1970	540.9584	503.6644	470.2786	450.7494	459.3959	480.2257	516.6868	557.2862	588.1876	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
Northeast					7.4200	14.6176	0.6300	0.7000			0.7700	33.1477 (75)	
East					4.1400	25.1925	0.6300	0.7000			0.7700	31.8746 (76)	
Southeast					1.8100	45.1778	0.6300	0.7000			0.7700	24.9905 (77)	
Southwest					4.9100	45.1778	0.6300	0.7000			0.7700	67.7920 (79)	
West					2.5800	25.1925	0.6300	0.7000			0.7700	19.8639 (80)	
Solar gains	177.6687	278.3713	433.8299	615.1892	708.9700	797.2911	731.4662	655.9836	519.5627	342.5420	216.7123	141.0215	(83)
Total gains	782.6848	878.8271	1011.0269	1156.1477	1212.6344	1267.5697	1182.2156	1115.3794	999.7884	859.2288	773.9985	729.2091	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.5332	16.6492	16.6492	16.7228	16.7228	16.7933	16.7933	16.8606	16.8606	16.7584	16.7933	16.7228	
alpha	2.1022	2.1099	2.1099	2.1149	2.1149	2.1196	2.1196	2.1240	2.1240	2.1172	2.1196	2.1149	
util living area	0.9154	0.8919	0.8399	0.7505	0.6243	0.4519	0.3361	0.3521	0.5744	0.7784	0.8817	0.9235	(86)
MIT	18.4132	18.6876	19.2425	19.8942	20.4632	20.8201	20.9350	20.9293	20.6770	20.0201	19.1444	18.3864	(87)
Th 2	19.7424	19.7500	19.7500	19.7547	19.7547	19.7593	19.7593	19.7636	19.7636	19.7570	19.7593	19.7547	(88)
util rest of house	0.9029	0.8763	0.8163	0.7127	0.5629	0.3618	0.2199	0.2317	0.4869	0.7339	0.8614	0.9121	(89)
MIT 2	17.4559	17.7271	18.2625	18.8790	19.3887	19.6715	19.7417	19.7442	19.5822	19.0166	18.1855	17.4390	(90)
Living area fraction									fLA = Living area / (4) =			0.1526	(91)
MIT	17.6020	17.8737	18.4121	19.0339	19.5527	19.8468	19.9239	19.9251	19.7493	19.1698	18.3319	17.5836	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4520	17.7237	18.2621	18.8839	19.4027	19.6968	19.7739	19.7751	19.5993	19.0198	18.1819	17.4336	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8724	0.8434	0.7814	0.6817	0.5433	0.3569	0.2213	0.2330	0.4737	0.7017	0.8277	0.8830	(94)
Useful gains	682.8219	741.1682	790.0033	788.1224	658.8329	452.3430	261.6370	259.8294	473.6473	602.9392	640.6398	643.8968	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1599.2119	1557.9918	1404.9244	1165.4707	826.8408	496.0052	270.9274	270.0081	559.4060	918.9575	1277.8788	1565.5563	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	681.7941	548.9055	457.5014	271.6908	124.9979	0.0000	0.0000	0.0000	0.0000	235.1176	458.8121	685.7147	(98)
Space heating													
Space heating per m2													(98) / (4) = 37.2691 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3828.2143 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	681.7941	548.9055	457.5014	271.6908	124.9979	0.0000	0.0000	0.0000	0.0000	235.1176	458.8121	685.7147	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	753.3637	606.5254	505.5264	300.2108	138.1192	0.0000	0.0000	0.0000	0.0000	259.7984	506.9747	757.6958	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	143.7645	110.0518	85.8047	41.8376	20.8479	0.0000	0.0000	18.2411	42.2779	87.0578	120.7083	144.8507	(64)
Efficiency of water heater	89.9260	89.9494	89.9791	90.0595	90.0283	87.3000	87.3000	87.3000	87.3000	89.6124	89.8143	89.9251	(217)
(217)m	159.8698	122.3487	95.3607	46.4556	23.1571	0.0000	0.0000	20.8948	48.4283	97.1493	134.3976	161.0792	(219)
Fuel for water heating, kWh/month	159.8698	122.3487	95.3607	46.4556	23.1571	0.0000	0.0000	20.8948	48.4283	97.1493	134.3976	161.0792	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													3828.2143 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													384.7794 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 776 * 1.00) =										-794.4149			-794.4149 (233)
Total delivered energy for all uses													4452.7199 (238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3828.2143	9.7400	372.8681	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	909.1410	9.7400	88.5503	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	384.7794	36.8500	141.7912	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-794.4149	36.8500	-292.7419	(252)
Total energy cost			460.5302	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3828.2143	0.2160	826.8943	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	909.1410	0.2160	196.3745	(264)
Space and water heating			1023.2688	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	384.7794	0.5190	199.7005	(268)
Energy saving/generation technologies				
PV Unit	-794.4149	0.5190	-412.3013	(269)

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Total kg/year 875.5429 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3828.2143	1.2200	4670.4215 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	909.1410	1.2200	1109.1521 (264)
Space and water heating			5779.5735 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	384.7794	3.0700	1181.2726 (268)
Energy saving/generation technologies			
PV Unit	-794.4149	3.0700	-2438.8536 (269)
Primary energy kWh/year			4905.7426 (272)
Primary energy kWh/m2/year			52.7726 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	85.0 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	620.90 (P1)
Transmission heat loss coefficient	86.87 (37)
Summer heat loss coefficient	707.77 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
East	0.000	1.000	None
South East	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	7.4200	106.0502	0.6300	0.7000	0.9000	281.0859
East	4.1400	125.2818	0.6300	0.7000	0.9000	185.2729
South East	1.8100	127.3119	0.6300	0.7000	0.9000	82.3135
South West	4.9100	127.3119	0.6300	0.7000	0.9000	223.2924
West	2.5800	125.2818	0.6300	0.7000	0.9000	115.4599
total:						887.4246

	Jun	Jul	Aug	
Solar gains	956	887	779	(P3)
Internal gains	467	448	456	
Total summer gains	1423	1335	1235	(P5)
Summer gain/loss ratio	2.01	1.89	1.75	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 85.0)	1.41	1.41	1.41	
Threshold temperature	18.82	20.59	20.45	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			